

Office Action Summary

Application No.

10/564,425

Applicant(s)

SUZUKI ET AL.

Examiner

Mark L. Shevin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 January 2006.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18-34 is/are pending in the application.
4a) Of the above claim(s) 27-34 is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 18-26 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 11 January 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/S508)
Paper No(s)/Mail Date 01/11/2006
4) ☒ Interview Summary (PTO-413)
Paper No(s)/Mail Date 20080103
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Status

1. Claims 18-34 are pending and the elected claims 18-26 are presented for the examination.

Election/Restrictions

2. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claims 18-26, drawn to a titanium alloy product.

Group II, claims 27-34, drawn to process of producing a titanium product

3. The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reason:

4. Lack of unity of invention may be directly evident "a priori," that is, before considering the claims in relation to any prior art, or may only become apparent "a posteriori," that is, after taking the prior art into consideration. For example, independent claims to A + X, A + Y, X + Y can be said to lack unity a priori as there is no subject matter common to all claims. In the instant case, two independent claims are directed to (1) a titanium alloy product having a compressive stress of ~270 MPa or more at a depth of 100 microns from a surface and (2) a process for producing the titanium part by

shot-peening and then machining off the surface of the treated part. In this case, "A" is the titanium alloy part, "X" is the surface compressive stress, and "Y" is the method of shot peening and machining. Therefore, the prior art of the record supports restriction into the groups as mentioned immediately above. The titanium alloy product does not have the shot peening feature of claim 27 nor does claim 27 have the level of residual compressive stress specified in claim 18.

Rejoining practice

5. The examiner has required restriction between product and process claims. Where applicant elects claims directed to the product, and a product claim is subsequently found allowable, withdrawn process claims that depend from or otherwise include all the limitations of the allowable product claim will be rejoined in accordance with the provisions of MPEP § 821.04. **Process claims that depend from or otherwise include all the limitations of the patentable product** will be entered as a matter of right if the amendment is presented prior to final rejection or allowance, whichever is earlier. Amendments submitted after final rejection are governed by 37 CFR 1.116; amendments submitted after allowance are governed by 37 CFR 1.312.

In the event of rejoinder, the requirement for restriction between the product claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103, and 112. Until an elected product claim is found allowable, an otherwise proper restriction requirement between product claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowed product claim will not be rejoined. See "Guidance on Treatment of Product and Process Claims in light of *In re Ochiai*, *In re Brouwer* and 35 U.S.C. § 103(b)," 1184 O.G. 86 (March 26, 1996). Additionally, in order to retain the right to rejoinder in accordance with the above policy, Applicant is advised that the process claims should be amended during prosecution either to maintain dependency on the product claims or to otherwise include the limitations of the product claims. **Failure to do so may result in a loss of the right to rejoinder.**

Telephonic Election

6. During a telephone conversation with Mr. Stephen Funk on 12 December, 2007 a provisional election was made to prosecute the invention of Group I, claims 18-26.

Affirmation of this election must be made by applicant in replying to this Office action. Claims 27-34 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) The invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. **Claim 18** is rejected under 35 U.S.C. 102(b) as being anticipated by **Wagner** (L. Wagner, Mechanical surface treatments on titanium, aluminum, and magnesium alloys. *Materials Science and Engineering A263* (1999), p. 210-216.

Wagner is drawn to the effect of mechanical surface treatments including shot-peening, roller-burnishing, and deep-rolling on fatigue performance (Abstract and Col. 1, p. 210). Fatigue behavior was studied on the (alpha+beta) titanium alloy Ti-6Al-7Nb and the metastable beta alloy Ti-3Al-8V-6Cr-4Mo-4Zr (Beta C). Figure 5 shows the beta C titanium sample as having a residual compressive stress of greater than 270 MPa down to a depth of at least 100 microns.

9. **Claim 18** is rejected under 35 U.S.C. 102(b) as being anticipated by **Lutjering** (Gerd Lutjering and James C. Williams, *Titanium*, Springer-Verlag, 2003, Section 1.5, Chapter 1 "Introduction", p. 8-11 and Section 3.7, Chapter 3, "Surface Treatment", p. 113-122.)

Lutjering, a textbook on Titanium, is drawn in chapter 3, section 7 to surface treatments for titanium and its alloys. First and foremost shot peening has been known

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to improve fatigue crack initiation resistance in steel and has been applied in titanium for the same purpose (p. 113, last paragraph). Again, the highlighted text of section 3.7.1 on page 114 reinforces this teaching. Most importantly, Figure 3.62 on page 115 shows a Ti-6Al-4V alloy and its residual stresses (MPa) as a function of depth (microns). The lower two curves representing shot peening at 6 and 10 bar show greater than a 270 MPa compressive stress within a depth of 100 microns from the surface of the samples.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

10. **Claims 19-26** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lutjering**.

Chapter 1, Section 1.5 "Traditional and Emerging Applications", is drawn to the applications of titanium. On page 8, Lutjering teaches that titanium has historically been used by Boeing in airframes and in landing gear. Airframes have to deal with fatigue as an engineering design consideration due to the numerous pressurization-

depressurization cycles in the cabin section and in wings and landing gear due to takeoff and landings. In consumer articles, beta titanium alloys are used for handlebars and seat posts on bicycles, the advantage of beta titanium in handlebars being the low modulus of elasticity (p. 10). Furthermore, Lutjering teaches that beta alloys have an advantage over alpha+beta alloys such as Ti-6Al-4V in that they have higher fatigue strength and lower modulus of elasticity (p. 11, para 1). Lastly, titanium has great potential in the automotive industry in valve springs, suspension springs, and connecting rods in the engine area (p. 11, para 2).

Furthermore, in chapter 3, section 3.7.1 Lutjering teaches that inadvertent surface damage (nicks, scratch, gouges or abusive machining yields a yield risk for fatigue failure (p. 114, para 3).

Regarding claim 19, the surface will inherently include a modified surface layer as it was subjected to shot peening to yield large compressive stresses and the instant specification teaches on Page 8-9, para 0045, that the beta phase in part of the surface region transitions to the alpha phase due to energy input (kinetic and heat) from shot-peening. Lutjering teaches that it is important to select an appropriate shot-peening intensity (kinetic energy) for a given alloy to maximize the benefits of peening (Fig. 3.67) and avoid overpeening that can actually reduce the fatigue life of a titanium part (p. 117, see highlighted text). The peening intensity, which gives rise to the phase change from beta to alpha (as beta is unstable and the kinetic energy and heat from peening provide the activation energy and driving force for the phase transformation of metastable beta) is recognized as a result effective variable is fatigue strength and thus it would have

been obvious to one having ordinary skill in titanium metallurgy at the time the invention was made to modify the shot-peening intensity to yield a given amount of alpha phase by volume at the surface of a titanium alloy part. Alternatively, it would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that there the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980).

Regarding claim 20, Lutjering taught the importance of surface treatments as fatigue cracks in particular initiate at the surface of components (p. 113) and that the more damaged the surface, the higher the risk of fatigue failure. One would infer conversely, and from an ordinary understanding of materials science, that a smoother surface would thus yield a lower risk of fatigue crack initiation. As is well-known in metallurgy, the smoother the surface of a part, the lower the risk of fatigue crack initiation and thus one of ordinary skill would be motivated to minimize surface roughness that acts as stress risers during part movement. It is well-known that improving the surface finish by polishing enhances fatigue life significantly.

Regarding claim 21, the instant specification (p. 2, para. 0005) discusses a low modulus of elasticity (Young's modulus) in titanium as being desirable because the spring height and total length of wire (and thus spring weight) used to produce a given amount of contraction or expansion can be reduced. Lutjering teaches that beta alloys have higher fatigue strength and lower modulus of elasticity compared to alpha+beta or

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alpha alloys (basically comparing beta phase to alpha phase by extension) (p. 11, para. 1). Thus it would be obvious to one of ordinary skill in titanium metallurgy to select an appropriate titanium alloy for the application as hand, particularly a high beta alloy as they are taught to have higher fatigue strength and low modulus of elasticity, both of which are crucial for known applications of titanium parts such as springs.

Regarding claims 22-26, it would have been obvious to one of ordinary skill in titanium metallurgy to use the hardened titanium part of claim 18 in a number of common titanium applications that demand high fatigue strength as Lutjering taught a number of useful applications for titanium including valve springs, suspension springs, and airframe components. It is well known in the art and taught by Lutjering that shot-peening and introducing a residual compressive stress in a sample is particularly beneficial to boosting fatigue resistance and thus using such a titanium part in a fatigue critical application is consequently obvious.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Aoki (US 6,224,686 B1)

Bush (US 3,073,022 A)

Neal (US 4,426,867)

Beals (US 5,704,239)

English Translation of **Toshino** (JP 61-170551)

1. Claims 18-26 are rejected

2. No claims are allowed

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The rejections above rely on the references for all the teachings expressed in the text of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588. The examiner can normally be reached on Monday - Thursday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on (571) 272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MSJanuary 3rd, 2008

/Vickie Kim/
Supervisory Patent Examiner, Art Unit 4116